

able mass of air is warmed, and since warm air is less dense than cold, it begins to rise, sometimes nearly vertically. If there is plenty of moisture in the soil and vegetation, these rising air currents carry up water vapor; which on cooling in the upper levels condenses into clouds.

If, however, there has been a drought of several weeks' duration, as frequently happens in the West in late autumn and early spring, the vertical air currents carry up quantities of fine soil particles, and these, swept along by the northwesterly storm winds, later descend on areas farther to the east as blinding clouds of dust.

Dust storms are possible even in the depth of winter, if there are areas left free of snow for any length of time. Such dust storms frequently become mingled with snow to form the blizzards that have well earned the soubriquet, "the gray tiger of the North," for such blizzards have so much dust in them that the air appears not white but gray.

The dust storms that seem so distressing to us nowadays are mere zephyrs by comparison with those that swept the mid-latitude of the earth at the close of the last great Ice Age. These, raging for probably scores of thousands of winters, piled up thick deposits of that peculiarly fine-grained soil known as "loess."

Science News Letter, December 2, 1933

MEDICINE

Smallpox Virus From Eggs "Takes" in Vaccination

SMALLPOX virus grown on fertile hen eggs has been used successfully to vaccinate eleven persons in Nashville, Tenn., Prof. E. W. Goodpasture and G. J. Buddingh of Vanderbilt University Medical School report in *Science*.

The vaccinations "took" as well as those performed on a group of controls vaccinated with the usual virus from calf lymph. Further studies are in progress to test the durability of the protection this method gives.

The method was developed by Prof. Goodpasture and his associate, A. M. Woodruff. German and British investigators have recently repeated the experiments successfully. Some advantages of the method are the ease with which the vaccine may be produced at any time fertile hen-eggs are available and the absence of bacteria or other contaminating agents.

Science News Letter, December 2, 1933

PHYSICS

10,000 Observations Yield New Cosmic Ray Theories

Conclusions That Rays Are Positive and More Abundant Conflict With Lemaître and Millikan Hypotheses

COSMIC rays are probably the hearts of atoms of ordinary matter, positively charged by the action of starlight on interstellar gas, and accelerated in some cosmic or possibly terrestrial electric field.

Ten thousand observations of cosmic ray intensities just completed in Panama and Peru and earlier studies in this country and Mexico have led Dr. Thomas H. Johnson of the Franklin Institute's Bartol Research Foundation in Swarthmore, Pa., to this conclusion, which is contrary to other theories of cosmic ray formation.

Using a sort of cosmic ray "telescope" that "sees" on a motion picture film only the cosmic rays that pass through three-in-line Geiger-Mueller counting devices and set off in them simultaneous electrical pulses, Dr. Johnson has now definitely established that the western sky is "brighter" with cosmic rays than the eastern sky. If our eyes could see the cosmic ray corpuscles as they do the waves of ordinary visible light, they would see more cosmic ray light in the west. This difference in cosmic ray brightness between the east and west is also greater at higher elevations and nearer the magnetic equator.

Less Near Magnetic Equator

Dr. A. H. Compton, University of Chicago Nobel in physics, and Dr. J. Clay, a Dutch physicist, have shown by their researches that the local intensity of the cosmic radiation decreases towards the magnetic equator. The lower equatorial intensities were readily explained by the supposition that part of the primary radiation consisted of electrified particles but these studies could not determine whether the electrical charges were positive or negative. By the same physical laws that make it possible to determine which way the electric current is flowing in the wires of a motor from the direction in which its armature rotates it is also possible to determine whether the charges of the cosmic rays are positive or negative

from the way their paths are bent by the magnetic field of the earth. The fact that they are bent towards the east and therefore enter from the west means that the rays are mostly positively charged as any high school physics student can verify. This fact was first indicated a year ago as a result of Dr. Johnson's studies on Mt. Washington.

No Negative Rays

His most recent work on the equator in Peru now gives him data which allow him to conclude that all of the cosmic ray corpuscles in the energy range which is affected by the earth's magnetic field in equatorial latitudes are positive and there are no negative rays. The fraction of the total radiation which now can be directly attributed to the electrified radiation is also much higher than had been supposed previously. In fact, these measurements show that at least forty per cent. of the total radiation is of this nature.

Most of the rays which are actually observed are known to be of secondary origin, produced in the atmosphere by the bombardment of the primary radiation. These secondary rays are positively and negatively charged corpuscles in about equal numbers, as Dr. Carl D. Anderson of California Institute of Technology has shown, but since their directions of motion are the same as those of the primary rays it is possible to use their directions as an indication of the directions of the primary rays before they enter the atmosphere.

His results lead Dr. Johnson to challenge several proposed theories of cosmic ray origin and propose a theory himself.

Favored Theory

One of the most favored theories was advanced by Abbé Georges Lemaître, the Belgian priest-cosmologist now lecturing at the Catholic University of America. The Lemaître theory supposes that cosmic rays were produced during the earliest stages of the evolution of the universe by the disintegration of huge

super-radioactive atoms. Under this theory cosmic rays would contain both negative and positive rays just as the radiation from radium does, and the absence of negative rays, Dr. Johnson points out, would be a denial of theory.

"The existence of but one sign of charge in this radiation," Dr. Johnson says, "is just what would be expected if the cosmic rays were produced by an electric field surrounding the earth. The direction of this field would have to be such that the positive ions, which are produced in interstellar space by the action of starlight on the small residue of gas, would accelerate towards the earth. It is extremely difficult to see how such a field could be maintained against the discharging action of the cosmic rays and of the negative rays which would be swept away from the earth by it. There is, however, some independent evidence from atmospheric electric measurements that such a field may exist."

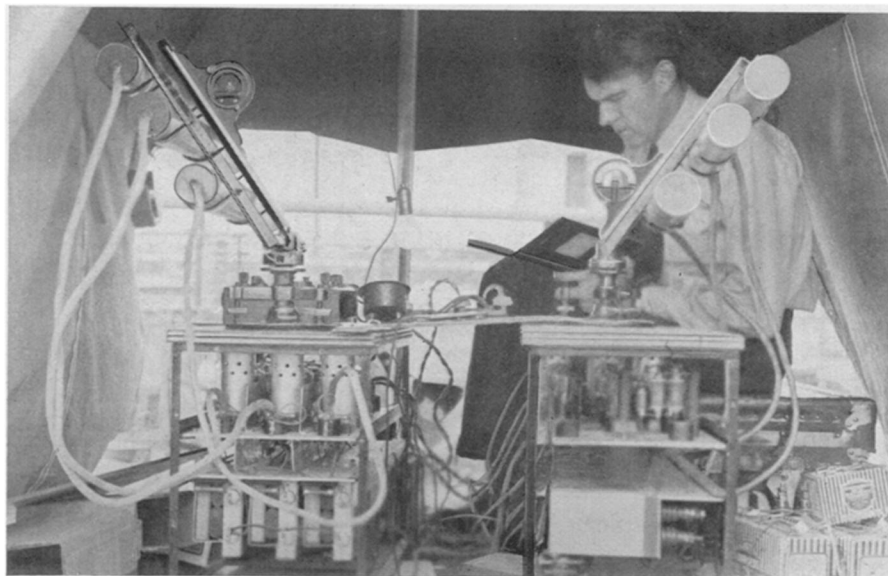
Dr. R. A. Millikan, California Institute of Technology physicist and Nobelist, recently concluded, on the basis of his theories, that a considerable portion of the total energy of the universe consists of cosmic radiation, but upon Dr. Johnson's theory the cosmic radiation would not be uniformly distributed throughout space and therefore the estimates of the total energy contained in cosmic radiation would need revision.

Counted 1,000,000 Rays

During his recent trip to Panama and Peru, Dr. Johnson with his automatic photographic instruments counted over a million cosmic rays. In Peru observations were taken upon mountains at elevations of 14,000 feet and 11,000 feet as well as sea level. Upon a previous trip this summer to Mexico, he made observations at 10,000 feet and 7,500 feet and sea level, while his colleague, Dr. E. C. Stevenson, made similar cosmic ray counts in Colorado at 9,500 feet elevation and at Swarthmore.

Clockwork and other automatic devices fitted to the cosmic ray counting device, given its try-out on Mt. Washington about a year ago, have allowed Dr. Johnson to gather large amounts of data and reduce markedly the probable error of his experiments which in many cases is now only about five per cent. Funds from the Carnegie Institution of Washington and the Carnegie Corporation of New York helped make possible the work and a preliminary report is published in *Physical Review*.

Science News Letter, December 2, 1933



COUNTING COSMIC RAYS

Dr. Thomas H. Johnson, Franklin Institute physicist, is shown with apparatus in his tent on a roof-top in Mexico during a recent expedition to measure cosmic rays.

ANTHROPOLOGY

Language Record Made Before "Last of Mohicans" Passed

THE LAST aged Indian who could speak the Mahican language died recently, in Milwaukee. So passed a man who might be called "the last of the Mohicans."

The novelist Cooper was a little premature in coining that phrase, the last of the Mohicans, for his Indian hero Mohicans, or Mahicans as scientists spell the name, have added many years to their history since Cooper wrote.

But William Dick, who could speak the old tongue, did represent the end of a phase in that history. The Mahican greetings that Cooper's Indian heroes would have exchanged so lustily will never again be spoken by an Indian. William Dick was the last person who knew them.

There is some comfort for science in the fact that several years ago, Dr. Truman Michelson of the Smithsonian Institution visited Mr. Dick and recorded carefully many words and sentences of his mother tongue. These records are now among the valued possessions of the Smithsonian. By the study of the Indian languages, it is possible to prove and check many events in America's Indian history; hence the importance of gathering data on these fast vanishing forms of speech.

Dr. Michelson, who reminisces about his work with Mr. Dick, admits one diplomatic error in dealing with the aged Mahican. He might have gathered more Mahican words and sentences, but for that unlucky tactical mistake.

The last of the Mahicans to speak the old language was no hard-fighting, sharp-shooting, befeathered redskin, but a dignified Presbyterian elder. The Mahican side of Mr. Dick clung to the memory of his native speech, but the Presbyterian side of him held grave fears that the old language was a relic of paganism, with which he should not be too much concerned—even for the worthy cause of science.

However, Dr. Michelson was persuasive and friendly, and the old Mahican gave his time to recalling the old speech. And then, one day, Dr. Michelson suggested that Mr. Dick excuse himself from teaching his Sunday School class to devote a Sunday to the language rescue work. And that upset the scientific apple cart. The Indian's worst suspicions were confirmed and he would work no longer.

Even William Dick does not represent the final passing of the Mahican tribe.

Science News Letter, December 2, 1933